

## PBBs (Polybrominated Biphenyls) in Michigan

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### What are PBBs (polybrominated biphenyls)?

Polybrominated biphenyls (PBBs) are man-made chemicals that were used as fire retardants in plastics that were used in a variety of consumer products. PBB is a relatively stable substance that is insoluble in water but highly soluble in fat. Manufacture of PBBs was discontinued in the United States in 1976.

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### What happened in Michigan in 1973?

In early 1973, both PBB (sold under the trade name FireMaster) and magnesium oxide (a cattle feed supplement sold under the trade name NutriMaster) were produced at the same St. Louis, Michigan plant by the Michigan Chemical Company. A shortage of preprinted paper bag containers led to 10 to 20 fifty-pound bags of PBB accidentally being sent to Michigan Farm Bureau Services in place of NutriMaster. This accident was not recognized until long after the bags had been shipped to feed mills and used in the production of feed for dairy cattle. By the time the mix-up was discovered in April 1974, PBB had entered the food chain through milk and other dairy products, beef products, and contaminated swine, sheep, chickens and eggs.

As a result of this incident, over 500 contaminated Michigan farms were quarantined, and approximately 30,000 cattle, 4,500 swine, 1,500 sheep, and 1.5 million chickens were destroyed, along with over 800 tons of animal feed, 18,000 pounds of cheese, 2,500 pounds of butter, 5 million eggs, and 34,000 pounds of dried milk products.

For a more detailed account of what happened during the Michigan PBB incident, see G.F. Fries' 1985 journal article.<sup>1</sup>

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<sup>1</sup> Fries GF. The PBB episode in Michigan: an overall appraisal. Crit Rev Toxicol. 1985;16(2):105-56. Review.

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## **What is the Michigan Department of Community Health (MDCH) doing about the PBB incident?**

Despite the destruction of very large quantities of contaminated animals, dairy, and meat products, people throughout Michigan were potentially exposed through consumption of these food products.

Measurements eventually showed that the overwhelming majority of Michigan residents who were exposed to PBB received very low levels. Initial screenings from a sample of people from quarantined farms confirmed that they had higher levels of PBB in their blood but could not determine that PBB had caused any immediate health effects. In order to track and study any possible long-term health effects, the **Michigan Long-Term PBB Study** began in 1976, coordinated by the then-named Michigan Department of Public Health, and has continued through the present time.

The Michigan Long-Term PBB Study: Since the late 1970s, MDCH has been studying a cohort of approximately 4,000 people, mainly families and neighbors on farms who consumed the most contaminated products, and their offspring. These individuals have completed health and exposure questionnaires, and have had their blood tested for levels of PBB and other chemicals in the environment. Information on cases of cancer and deaths are also recorded.

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## **Do PBBs cause cancer?**

It is not known whether PBBs can cause cancer in humans, but we know that they can cause liver cancer in rats and mice. The U.S. Department of Health and Human Services (HHS) determined that PBBs may reasonably be anticipated to be carcinogens.

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## **How does PBB exposure affect humans?**

Some PBB-exposed Michigan residents complained of nausea, abdominal pain, loss of appetite, joint pain, fatigue and weakness. However, it could not clearly be established that PBBs were the cause of these health problems. There is stronger evidence that PBBs may have caused skin problems, such as acne, in some people who ate contaminated food. Some workers exposed to PBBs by breathing and skin contact for days to months also developed acne.

Recent studies, including those involving the Michigan Long-Term Study participants, have suggested that PBB and other related chemicals, such as PCBs<sup>2</sup>, may interact with the endocrine system<sup>3</sup> and disrupt its natural balance (see the next section).

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<sup>2</sup> **PCBs** Polychlorinated biphenyls are a mixture of compounds very similar to PBBs. The difference between the two is the substitution of chlorine for bromine in PBBs. PCBs are man-made chemicals, used in electrical equipment. Manufacture of PCBs was banned in the U.S. in 1977, but they persist as environmental contaminants.

<sup>3</sup> **Endocrine system** The group of organs and glands that work together to secrete hormones into circulation. The endocrine system plays an important role in growth and development of infants and children as well as the reproductive capacity of adults.

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## **What are the results of the long-term study?**

There is no one definitive result of the study: the Michigan Long-Term PBB Study has been very valuable in that researchers have been able to amass a wealth of data by following the same group of people over the course of more than 30 years following their exposure. Much of what scientists know about the human health effects of PBB contamination has been learned from the Michigan study, and numerous scientific articles stemming from the Michigan cohort data have been published over the years. It should be noted that these studies are based on population measurements of disease and the results are not directly applicable to individuals. Some of the more recent research is summarized below:

There is some evidence linking high PBB exposure to an increased risk of cancers of the breast and the digestive system and for lymphoma, but the numbers of cases reported are yet too few to draw firm conclusions. Increased rates of neurologic, immunologic, dermatologic, and musculoskeletal effects have been noted in the cohort; however, these effects do not show a consistent relationship with serum PBB levels.

Some recent results failed to show an association for PBB exposure with benign breast disease and duration of lactation, while some preliminary and as yet unpublished results also failed to show an association for PBB exposure with infertility, endometriosis, fibroids, thyroid dysfunction or hip fractures. However, spontaneous abortion rates were elevated among second-generation women born after the Michigan PBB incident. In addition, a high initial PBB serum level in conjunction with a recent weight loss (suggesting the potential release of stored PBBs) showed associations with a shorter menstrual cycle and with a longer bleed time during menstruation.

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## **How do I know that I've been exposed to PBB?**

There are tests that can detect PBBs in blood, body fat, and breast milk. These tests can tell whether you have been exposed to high levels of the chemicals, but cannot tell the exact amount or type of PBB you were exposed to, nor whether harmful effects will occur. These tests are not routinely available at the doctor's office, but samples can be sent to laboratories that have the appropriate equipment. The MDCH Bureau of Laboratories provides serum testing for Long-Term PBB Study members (see contact info below).

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## **Do PBBs leave the body after exposure?**

Yes, gradually. However, there is no medical treatment that will lower PBB levels in the human body.

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## **How long does it take for PBBs to leave the body?**

Daniel Rosen from the Centers for Disease Control (CDC) in Atlanta, GA published a 1995 article in Environmental Health Perspectives citing 10.8 years as the calculated half-life of PBBs within the human body among those enrolled in the Long-Term PBB Study. This rate is not an absolute, but the average amount of time for half of the PBBs stored in the body to be excreted by natural processes. Currently, 30 years after the exposure period, this article suggests that the amount of PBBs in circulation in a typical human has likely halved approximately 3 times. For example, a person with a relatively high level of serum PBBs in 1973, like 10 ppb (parts per billion), today would likely measure less than 2 ppb in his blood. Furthermore, 10 years from today (2014) we could expect the serum PBB levels to be lower than the smallest detectable level of 1ppb.

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## Where can I get more information?

Agency for Toxic Substances and Disease Registry (ATSDR) **1-888-422-8737** or email [ATSDRIC@cdc.gov](mailto:ATSDRIC@cdc.gov); <http://www.atsdr.cdc.gov/tfacts68.html> (ToxFAQ, frequently asked questions about PBBs) or <http://www.atsdr.cdc.gov/toxprofiles/tp68.html> (Tox Profile, a comprehensive review of all the PBB research)

Michigan Department of Community Health (MDCH), Division of Environmental and Occupational Epidemiology (DEOE), **1-800-MI-TOXIC (1-800-648-6942)**, [www.michigan.gov/mdch-toxics](http://www.michigan.gov/mdch-toxics). Click on the Division overview for information on PBB-related activities.

Cohort-participant newsletters

[PBB News Update Fall, 2000](#)

[PBB News Update Fall, 2003](#)

If you cannot access the newsletters on the Web, call the DEOE number above to request a paper copy.

[MDCH Lab Services, PBB Unit](#) 517-335-8063

Recent article in Lansing weekly, the *City Pulse*, written by Dave Dempsey, policy advisor for the Michigan Environmental Council: <http://www.lansingcitypulse.com/031001/health/>

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## Recently published papers using Michigan Long-Term PBB Study data

Blanck HM, Marcus M, Tolbert PE, Rubin C, Henderson AK, Hertzberg VS, Zhang RH, Cameron L. Age at Menarche and Tanner Stage in Girls Exposed In Utero and Postnatally to Polybrominated Biphenyl. *Epidemiology*. 2000 Nov;11(6):641-647.

Blanck HM, Marcus M, Hertzberg V, Tolbert PE, Rubin C, Henderson AK, Zhang RH. Determinants of polybrominated biphenyl serum decay among women in the Michigan PBB cohort. *Environ Health Perspect*. 2000 Feb;108(2):147-52.

Henderson AK, Rosen D, Miller GL, Figgs LW, Zahm SH, Sieber SM, Rothman N, Humphrey HE, Sinks T. Breast cancer among women exposed to polybrominated biphenyls. *Epidemiology*. 1995 Sep;6(5):544-6. Erratum in: *Epidemiology* 1996 Mar;7(2):216.

Hoque A, Sigurdson AJ, Burau KD, Humphrey HE, Hess KR, Sweeney AM. Cancer among a Michigan cohort exposed to polybrominated biphenyls in 1973. *Epidemiology*. 1998 Jul;9(4):373-8.

Kaiser R, Marcus M, Blanck HM, Naughton M, Zhang RH, Henderson AK, Tolbert PE, Rubin CH, Hertzberg VS. Polybrominated biphenyl exposure and benign breast disease in a cohort of US women. *Ann Epidemiol*. 2003 Jan;13(1):16-23.

Rosen DH, Flanders WD, Friede A, et al. 1995. Half-life of a polybrominated biphenyl in human sera. *Environ Health Perspect* 103(3):272-274.

Sweeney AM, Symanski E, Burau KD, Kim YJ, Humphrey HE, Smithci MA. Changes in serum PBB and PCB levels over time among women of varying ages at exposure. *Environ Res*. 2001 Jun;86(2):128-39.

Thomas AR, Marcus M, Zhang RH, Blanck HM, Tolbert PE, Hertzberg V, Henderson AK, Rubin C. Breast-feeding among women exposed to polybrominated biphenyls in Michigan. *Environ Health Perspect*. 2001 Nov;109(11):1133-7.

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*Michigan Department  
of Community Health*



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Janet D. Olszewski, Director